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Onchocerciasis and ABO Blood Group Status: A Field Based Study

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Abstract: The distribution of ABO blood group was investigated among onchocerciasis patients in Agbokim, a rural community within the Cross River basin Nigeria. A total of 398 individuals comprising 224 clinically and parasitologically confirmed onchocerciasis patients and 174 apparently healthy age-matched individuals (control) were used for this study. Frequencies of the blood groups were 62.06% for blood group O, A (17.84%); B (16.58%) and AB (3. 52%). The gene frequencies were, O (0.621), A (0.178), B (0.166) and AB (0.035), while the allelic frequencies were P = 0.11, q = 0.10 and r = 0.79. There was a significant ($p<0.05$) association between ABO blood group system and onchocerciasis infection with blood group O subjects being more susceptible to infection than the other blood groups. The possible exploitation of this association in the production of candidate vaccine and/or potent drug against the adult worm is discussed.

Key words: Onchocerciasis, blood group, cross river basin, Nigeria

INTRODUCTION

Onchocerciasis is one of the most socio-economically devastating parasitic diseases of man (Usip *et al*., 2006). It remains a serious public health problem in large parts of tropical Africa with nearly half of the river blindness disease found in Nigeria (Edungbola, 1991; Nwoke and Dozie, 1998).

Blood group and haemoglobin genotypes have been known to predispose individuals to or protect them from various diseases or infections (Omoregie *et al*., 2002). The existence of blood group substances in many human pathogens and the possible explanation that these shared antigen between pathogens and host are important in the pathogenesis and prognosis of phenomena of auto-immunity and immune tolerance had earlier been reported (Mourant, 1976). There are reports of significant association between ABO blood group and tuberculosis infection (Omoregie *et al*., 2002) and malaria infection (Agbonlahor *et al*., 1993; Opara *et al*., 2006). Contrastly, no association was observed between bancroftian filariasis, loiasis and ABO blood groups (Tyorkos *et al*., 1983; Ogunba *et al*., 1970; Rifaat *et al*., 1978; Romea *et al*., 1988). ABO blood group distribution and other haematological data are known to be characteristic of ethnic groups (Worlledge *et al*., 1974) and their susceptibility to disease differ from one population to another.

This study aims at providing information on the association of onchocerciasis and ABO blood groups, with a view to contributing to existing knowledge on blood groups and susceptibility to diseases.

MATERIALS AND METHODS

Study site: The study was carried out in Agbokim a rural community that is endemic for onchocerciasis in the Cross River Basin Nigeria. The detailed description of the study site are given elsewhere (Opara *et al*., 2005).

Study population: The survey was carried out between August and November 2001. Before the survey was undertaken in the village the purpose of the study was discussed with the village head and opinion leaders, consent was sought and granted. Thereafter, the entire community was mobilized to participate in the study voluntarily. Since, the study involved obtaining physiological material from individual consent of the individual was sought and obtained. The Cross River State Ministry of Health approved of the study.

Blood collection: A total of 398 subjects comprising of 224 clinically and laboratory confirmed onchocerciasis patients and 174 apparently healthy (not positive for onchocerciasis) age-matched individuals which served as control participated in this study. Each individuals thumb was first cleaned with a methylated spirit before venipunture using a sterile lancet. Blood groups were determined by the direct slide method, using agglutinating A, B, or D anti-sera (Kassim and Ejezie, 1982a). The sex, age, date of diagnosis, location of donor and blood group was recorded on the epidemiological field form.

Data analysis: The chi-square (χ^2) test was used to measure proportion of the distribution while allelic and gene frequencies were determined as described by Mourant (1976).

RESULTS

The blood group distribution in the 398 subjects is presented in Table 1. The frequencies of the blood group were O (62.06%), A (17.84%), B (16.58%) and AB (3.52%). Of the 71 subjects with blood group A, 50 (22. 32%) were infected with *Onchocerca volvulus* microfilariae while 21 (12.07%) were not infected. A total of 66 subjects had blood group B with 37 (16.52%) infected with *O. volvulus* microfilariae while 29 (16.67%) were not infected. About 5.36% of subjects with blood group were infected. People with blood group O had the highest infection rate (55.80%). There was a significant difference between the infected and uninfected (control) blood group in the study area ($\chi^2 = 13.93$; $p<0.05$) (Table 1). The relationship between ABO blood group and gender is shown in Table 2. Female 136 (60.71%) were significantly more infected than males 88 (39.29%) ($\chi^2 = 13.02$; $p<0.05$).

The gene and allelic frequency of the different blood group is shown in Table 3. Gene frequencies of the ABO blood group recorded were A(0.178), B(0.166), AB(0.035) and O(0.621), while the allelic frequencies were (p (0.11); q (0.10), r (0 .79). The values of the gene and allelic frequency sum up to one, respectively indicating a stable population.

Table 1: Blood group distribution among the studied population

	Infected		Control		Total	
Blood group	No Infected	(%)	No Uninfected	(%)	No Examined	(%)
A	50	22.32	21	12.07	71	17.84
B	37	16.52	29	16.67	66	16.58
AB	12	5.36	2	11.49	14	3.52
O	125	55.80	122	70.12	247	62.06
Total	224	100.00	174	100.00	398	100.00

Table 2: Blood group distribution by sex

Blood group	Male (%)	Female (%)	Total (%)
Infected			
A	17 (7.60)	13 (14.73)	50 (22.32)
B	10 (4.46)	27 (12.05)	37 (16.52)
AB	10 (4.46)	2 (0.90)	12 (5.36)
O	41 (18.30)	84 (37.50)	125 (55.80)
Total	88 (39.30)	136 (60.70)	224 (100.00)
Control			
A	4 (2.30)	17 (9.77)	21 (12.07)
B	22 (12.64)	7 (4.02)	29 (16.67)
AB	0 (0.00)	2 (1.15)	2 (1.15)
O	74 (42.52)	48 (27.60)	122 (70.12)
Total	100 (57.47)	74 (42.53)	174 (100.00)

Table 3: Allelic and gene frequencies of the studied population

Blood group	No examined	Examined (%)	Gene frequency	Allelic frequency
A	71	17.84	0.178	p = 0.11
B	66	16.58	0.166	q = 0.10
AB	14	3.52	0.035	-
O	247	62.06	0.621	r = 0.79
Total	398	100.00	1	1

p+q+r = Hardy Weinberg's formulae

DISCUSSION

This study has determined through a field rather than a hospital based study, the ABO blood group frequencies in an onchocerciasis endemic community. The result shows that group O individuals are more predominant than the other blood groups, while the A and B blood groups appear to be equally distributed. This observation is similar to other studies (Gilles, 1965; Worlledge *et al*., 1974; Kassim and Ejezie, 1982, 1982b; Araba, 1976; Nkuo-Akenji *et al*., 2004), suggesting no major differences in the gene frequencies with other ethnic groups in Nigeria and Africa. Gene frequencies among desirable random population of people will give more accurate distribution pattern among the persons. The sum of the gene frequencies is 1 indicating that the population is in equilibrium in that factors like natural selection, migration and mutation which tends to change gene frequencies are not operational or has little effect. This finding is consistent with the reports of Kassim and Ejezie (1982).

In this study there was no preferential infection by onchocerciasis on any of the blood groups of the subjects studied, however the rate of infection was significant, indicating a relationship between onchocerciasis and ABO blood group. This result is in agreement with other workers (Facer and Brown, 1979; Miller *et al*., 1976; Nkuo-Akenji *et al*., 2004). This observation contrasts with the findings of other studies (Romea *et al*., 1988; Rifaat *et al*., 1978; Kassim and Ejezie, 1982), who reported no association between ABO blood group and of the diseases they studied. According to Aird *et al.* (1953) inaccuracy of diagnosis, inadequacy of control and sample size are factors that cause contradiction in blood group association with disease studies. These factors might have accounted for the difference in results obtained by various investigators. Further studies are required to clarify these observations. The indigenous populations are more than 60% blood group O and these were more severely infected with onchocerciasis than the other blood group. It is conceivable that the high percentage of those with onchocerciasis belonging to blood group O might be due to preponderance of this blood group in the study population. Aird *et al.* (1953) postulated the theory of selectivity as accounting for the difference in susceptibility to infection of the ABO blood groups. In the present study, there is no evidence to suggest the importance of this selectivity in our results because more than half of each of the blood group were infected.

In this study the ABO blood group is associated with human onchocerciasis infection. It is evident from this study that there is need for more investigations to be

carried out in several epidemiological settings with varied levels of onchocerciasis endemicity to better evaluate the susceptibility of ABO blood group to onchocerciasis infection. Furthermore more molecular and biochemical studies should be carried out on infected blood groups for possible exploitation in the production of potent drugs against the adult worm.

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